



Introduction

The XR22414 evaluation board is for the Exar USB 2.0 4-Port hub in both the 48 pin LQFP and 48 pin QFN packages. This manual is intended to guide users to use various functions and configurations of the hub device. Either the 48 pin LQFP package or 48 pin QFN package EVB can be ordered as shown in Table 1.

Table 1: Ordering Information

Device Ordering Part Number	Evaluation Board Ordering Part Number	Device Package	Device Location
XR22414CV48-F	XR22414CV48EVB	LQFP 48	U1
XR22414CL48-F	XR22414CL48EVB	QFN 48	U2

Board Layout and Outline

Evaluation Board outline

Figure 1 shows the topography of the evaluation board. Either U1 or U2 will be installed depending upon the version of the evaluation board.

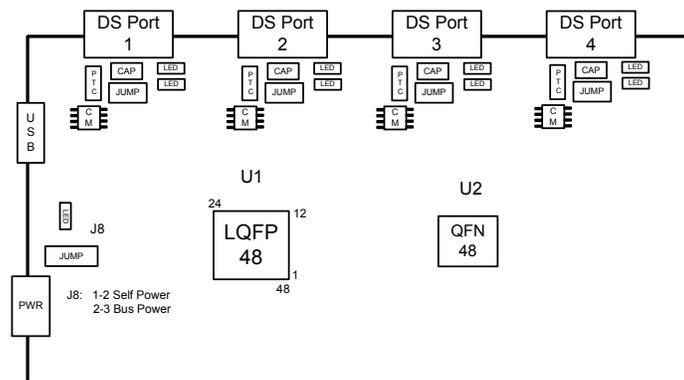
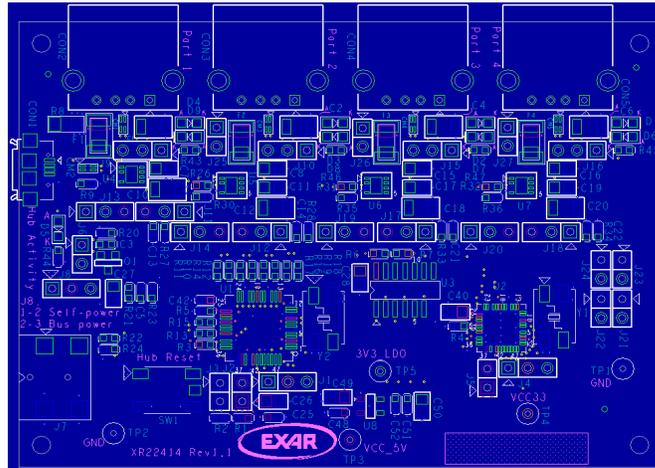


Figure 1: XR22414 PCB Outline

Evaluation Board Layout



Evaluation Board Picture

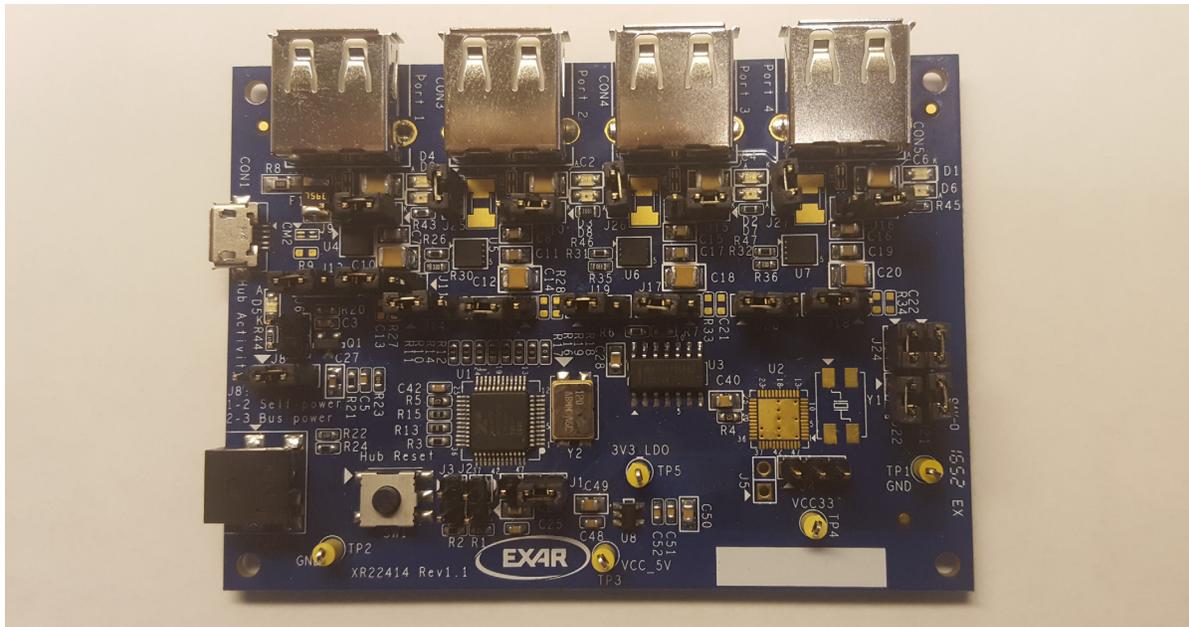


Figure 2: XR22414 PCB

Hardware Configuration

This section describes the default board settings, when shipped from the factory, and jumper settings that may be used to reconfigure operation.

Differences between XR22414CV48EVB and XR22414CL48EVB

The XR22414 is available in two packages, a 48 pin LQFP and a 48 pin QFN. The two versions of the evaluation board use the same bare PCB, but with different components assembled, which includes either the LQFP or QFN package. In order to avoid trace stubs on high speed USB (480 MHz) nets, 0 ohm resistors are installed from the upstream and all four down-

stream USB ports to connect to the QFN48 device for the XR22414CL48EVB. These resistors are not installed for the LQFP48 EVB.

Power Configurations

The XR22414 EVB may operate in either bus powered or self-powered modes. The power mode must be selected by jumper J8. If self-powered, the device uses the 5V supplied by the external 5V DC input to J8 power jack. When bus powered, the XR22414 may not be capable of providing sufficient power to all downstream ports. By USB specification, in bus powered mode, each downstream port may draw 100 mA maximum and the hub itself may draw an additional 100 mA. In self-powered mode, external 5V must be supplied to the PCB via the J7 power connector and each downstream port may draw up to 500 mA.

The XR22414 EVB may alternately operate from a 3.3V input. To power the device from 3.3V the REG_EN# pin must be deasserted and the VCC5 pin must not be connected to a 5V source. The 3.3V power input to should be provided to all VCC33 pins and the 3V3_OUT pin will not provide an output voltage.

The XR22414 EVB can be configured for either individual or global power monitoring and ganged power control. In individual mode, each port is monitored by an XRP2527 power monitor circuit. In global mode, all four downstream ports power is combined and monitored by a single monitor circuit. Alternately, power to the downstream ports of the XR22414 EVB can be monitored by a resettable PTC fuse, or by both the fuse and the power monitor devices. Over-current conditions detected by either XRP2527 current monitors or PTC fuses are signaled to the OVC# pin of the device, and power out pins (PWR#) are deasserted to then power down downstream ports.

Table 2 defines the jumper settings on the XR22414 EVB, and the default settings of each jumper when shipped from the factory.

Table 2: Jumper Settings and components for PCB Power

Jumper	Description	Default
J8	J8 must be installed either pin 1 to 2 when the XR22414 is self-powered or pin 2 to 3 when the device is bus powered.	By default J8 is installed pin 1 to 2
J6	J6 can be used to bypass the inrush current limiting circuit when the XR22414 is bus powered.	By default J6 is not installed
J1, J2, J3, J4, J5	To power the device from 3.3V instead of 5V, the top surface trace across jumper J3 must be cut disabling the 5V to 3.3V internal regulator. For the XR22414CV48EVB the top surface trace across jumper J2 must also be cut and J1 must be installed from pin 2 to 3 to use the external 3.3V LDO voltage. For the XR22414CL48EVB J5 trace must be cut and J4 must be installed pin 2 to 3.	J2, J3 and J5 are normally not installed. By Default, J1 in installed pin 1 to 2 for the XR22414CV48EVB or J4 is installed pin 1 to 2 for the XR22414CL48EVB.
J21, J22, J23, J24, J25, J26, J27	J21 is used to select global over current monitoring for downstream port over-current protection. When J21 is installed, global over-current monitoring is selected. When J21 is not installed, individual port over-current monitoring is selected. If J21 is installed, J25, J26 and J27 should also be installed to connect port power for all downstream ports together and J22, J23, and J24 should also be installed to connect unused OVCn# pins to ground.	By default J21, J22, J23, J24, J25, J26 and J27 are not installed.
J9, J10, J15, J16	J9, J10, J15 and J16 are used to select whether the PTC fuse only or current monitor (XRP2527) device is used for downstream port over-current protection.	By default J9, J10, J15 and J16 are installed from pin 1 to 2.
J11, J12, J17, J18	If J9, J10, J15 and J16 are installed pin 1 to 2, J11, J12, J17 and J18 select whether XRP2527 over-current monitor only or PTC fuse and current monitor devices protect downstream ports.	By default J11, J12, J17 and J18 are installed from pin 2 to 3.

Table 2: Jumper Settings and components for PCB Power

Jumper	Description	Default
J13, J14, J19, J20	When J13, J14, J19 and J20 are installed from pin 2 to 3, the XRP2527 current monitors use USB 2.0 default trip voltage. If installed pin 1 to 2, the current monitors trip at the value established by the resistance of the RSET pin to ground using formula $ILIM$ (trip current) = $\sim 108.7 / RSET$ resistance (kOhms).	By default, J13, J14, J19 and J20 are installed pin 1 to 2.
J9	J9 selects normal hub operation port and hub activity indicators or charging mode.	By default J9 is installed pin 2 to 3 for normal hub operation and LED activity indicators. Must be installed pin 1 to 2 to enable charging mode.
F2, F3, F4	F1, F2, F3 and F4 may be used instead of, or in conjunction with the XRP2527 current monitors. Only F1 is populated by default on the XR22414 EVB with the intent that F1 may be used in global over-current protection modes.	Only F1 is populated by default

Uninstalled components on XR22414CV48EVB and XR22414CL48EVB

Both XR22414 EVBs have a number of components that are not installed. These components have a variety of purposes and some may be installed after cutting the surface “shorting traces” which short across the pins of the devices when they are not installed.

Table 3: Uninstalled Components

Uninstalled Components	
J2 & J5	By default J2 and J5 are not installed. For power measurements, an ammeter may be installed by cutting either the surface trace on J2 (when using the LQFP48 device) or J5 (when using the QFN48 device). J1 or J2 can then be installed or an ammeter in series can be used for power measurements.
J3, J6	By default J3 and J6 not installed.
CM1 - CM5	Common Mode chokes on upstream and 4 downstream ports for EMI purposes.
R10- R19	R10- R19 are not installed on XR22414CV48EVB to prevent stubs on high speed USB traces.
C13, C14, C21, C22, R27, R28, R33, R34	C13, C14, C21, C22, R27, R28, R33, and R34 are not installed.
Y1 / Y2 and R4 / R5	For the XR22414CV48EVB Y1 and R4 are not installed. For the XR22414CL48EVB Y2 and R5 are not installed.

LED Indicators

Each USB port of the XR22414 EVBs has green and amber activity indicators. The upstream port has a single blue LED to indicate any hub activity. The hub activity LED is lit when the hub is connected to a USB host. However, if there are no downstream ports connected, following device enumeration and a short period of inactivity, the hub will be placed in suspend state and the hub activity LED will not be lit. The 4 downstream ports have green LEDs for port activity and amber indicators for error indications including over-current per USB 2.0 specifications chapter 11.

XR22414 Evaluation Board Bill of Materials

The Bill of Materials for the two versions of the XR22414 evaluation boards are in the following tables. The XR22414CV48EVB BOM is in Table 4 and XR22414CL48EVB in Table 5. Several component part numbers marked "DNI" may typically be not installed on the Exar evaluation boards. However, these may be used on customer PCBs for EMI or other purposes as desired.

Table 4: XR22414CV48EVB BOM (Rev. 1.1 PCB)

Item	Qty	Ref. Des	Description	Part Number
1	5	CM1, CM2, CM3, CM4, CM5	Common Mode Choke Surface Mount	744230900_DNI
2	4	CON2, CON3, CON4, CON5	USB Conn, Receptable, A-type	61400416021
3	1	CON1	Connector, USB_MICRO_ B	629105150521
4	8	C1, C2, C4, C6, C10, C12, C18, C20	Ceramic Capacitor, 47uF/16V 1210	885012109011
5	2	C26, C27	Ceramic Capacitor, 4.7uF/16V 0805	885012107013
6	2	C28, C40	Ceramic Capacitor, 10uF/16V 0805	885012107014
7	10	C7, C8, C9, C11, C15, C16, C17, C19, C49, C50	Ceramic Capacitor, 1uF/16V, 0805	885012207051
8	16	C3, C5, C23, C25, C31, C35, C36, C37, C38, C42, C43, C44, C45, C48, C51, C52	Ceramic Capacitor, 100nF/25V 0603	885012206071
9	4	D2, D3, D4, D5	LED, Green, 0805	150080GS75000
10	1	D5	LED, Blue, 0805	150080BS75000
11	4	D6, D7, D8, D9	LED, Amber, 0805	150080YS75000
12	1	F1	PTC Resettable, 0.75A 8V 1812	MF-MSMF075-2
13	3	F2, F3, F4	PTC Resettable, 0.75A 8V 1812 DNI	MF-MSMF075-2_DNI
14	14	J1, J8, J9, J10, J11, J12, J13, J14, J15, J16, J17, J18, J19, J20	3 Positions Header, 0.100" (2.54mm)	61300311121
15	1	J4	3 Positions Header, 0.100" (2.54mm) DNI	61300311121_DNI
16	7	J21, J22, J23, J24, J25, J26, J27	2 Positions Header, 0.100" (2.54mm)	61300211121
17	4	J2, J3, J5, J6	2 Positions Header, 0.100" (2.54mm)	61300211121_DNI
18	1	J7	Connector, Power Jack, DC RA SMD	694103107102
19	1	Q1	MOSFET P-CH 12V 4.1A SOT-23	SI2333DS-T1-E3
20	1	R5	Resistor, 2.7 kOhm, 1%, 0603	
21	1	R8	Resistor, 0 Ohm, 0603	
22	11	R9, R10, R11, R12, R13, R14, R15, R16, R17, R18, R19	Resistor, 0 Ohm, 0603 DNI	DNI
23	4	R29, R30, R35, R36	Resistor, 215 kOhm, 5%, 0603	
24	10	R2, R3, R6, R7, R21, R24, R25, R26, R31, R32	Resistor, 10 kOhm, 5%, 0603	
24	1	R23	Resistor, 100 kOhm, 5%, 0603	
25	1	R28, R28,R33, R34	Resistor, 100 kOhm, 5%, 0603	DNI
26	2	R1,R22	Resistor, 5.1 kOhm, 5%, 0603	

Table 4: XR22414CV48EVB BOM (Rev. 1.1 PCB)

Item	Qty	Ref. Des	Description	Part Number
27	1	R44	Resistor, 470 Ohm, 5%, 0603	
28	4	R43, R45, R46, R47	Resistor, 2 kOhm, 5%, 0603	
29	1	R20	Resistor, 40.2 KOhm, 1%, 0603	
30	1	SW1	Switch, SPST-NO	431481031816
31	5	TP1, TP2, TP3, TP4, TP5	Test Point PC Mini .040"D Yellow	36-5004-ND
32	1	U1	IC, USB 2.0 Hub, 4 Port, LQFP48	XR22414CV48-F
33	4	U4, U5, U6, U7	USB Current Monitor, DFN8 2x3	XRP2527IHB-1-F
34	1	U8	LDO 5V to 3.3V	SP6260GEK-L/TR_DNI
35	1	U3	Hex Inverter IC	SN74LVC14ADRG3
36	1	Y2	12MHz \pm 20ppm Crystal 18pF -20°C ~ 70°C 4-SMD	ABMM-12.000MHZ-B2-T

Note: Part numbers marked _DNI are not installed.

Table 5: XR22414CL48EVB BOM (Rev. 1.1 PCB)

Item	Qty	Ref. Des	Description	Part Number
1	5	CM1, CM2, CM3, CM4, CM5	Common Mode Choke Surface Mount	744230900_DNI
2	4	CON2, CON3, CON4, CON5	USB Conn, Receptable, A-type	61400416021
3	1	CON1	Connector, USB_MICRO_ B	629105150521
4	8	C1, C2, C4, C6, C10, C12, C18, C20	Ceramic Capacitor, 47uF/16V 1210	885012109011
5	2	C26, C27	Ceramic Capacitor, 4.7uF/16V 0805	885012107013
6	2	C28, C40	Ceramic Capacitor, 10uF/16V 0805	885012107014
7	10	C7, C8, C9, C11, C15, C16, C17, C19, C49, C50	Ceramic Capacitor, 1uF/16V, 0805	885012207051
8	15	C3, C5, C24, C25, C30, C32, C33, C34, C39, C42, C46, C47, C48, C51, C52	Ceramic Capacitor, 100nF/25V 0603	885012206071
9	4	D2, D3, D4, D5	LED, Green, 0805	150080GS75000
10	1	D5	LED, Blue, 0805	150080BS75000
11	4	D6, D7, D8, D9	LED, Amber, 0805	150080YS75000
12	1	F1	PTC Resettable, 0.75A 8V 1812	MF-MSMF075-2
13	3	F2, F3, F4	PTC Resettable, 0.75A 8V 1812 DNI	MF-MSMF075-2_DNI
14	14	J4, J8, J9, J10, J11, J12, J13, J14, J15, J16, J17, J18, J19, J20	3 Positions Header, 0.100" (2.54mm)	61300311121
15	1	J1	3 Positions Header, 0.100" (2.54mm) DNI	61300311121_DNI
16	7	J21, J22, J23, J24, J25, J26, J27	2 Positions Header, 0.100" (2.54mm)	61300211121
17	4	J2, J3, J5, J6	2 Positions Header, 0.100" (2.54mm)	61300211121_DNI
18	1	J7	Connector, Power Jack, DC RA SMD	694103107102

Table 5: XR22414CL48EVB BOM (Rev. 1.1 PCB)

Item	Qty	Ref. Des	Description	Part Number
19	1	Q1	MOSFET P-CH 12V 4.1A SOT-23	SI2333DS-T1-E3
20	1	R4	Resistor, 2.7 kOhm, 1%, 0603	
21	12	R8, R10, R11, R12, R13, R14, R15, R16, R17, R18, R19	Resistor, 0 Ohm, 0603	
22	1	R9	Resistor, 0 Ohm, 0603 DNI	DNI
23	4	R29, R30, R35, R36	Resistor, 215 kOhm, 5%, 0603	
24	10	R2, R3, R6, R7, R21, R24, R25, R26, R31, R32	Resistor, 10 kOhm, 5%, 0603	
24	1	R23	Resistor, 100 kOhm, 5%, 0603	
25	1	R28, R28,R33, R34	Resistor, 100 kOhm, 5%, 0603	DNI
26	2	R1,R22	Resistor, 5.1 kOhm, 5%, 0603	
27	1	R44	Resistor, 470 Ohm, 5%, 0603	
28	4	R43, R45, R46, R47	Resistor, 2 kOhm, 5%, 0603	
29	1	R20	Resistor, 40.2 KOhm, 1%, 0603	
30	1	SW1	Switch, SPST-NO	431481031816
31	5	TP1, TP2, TP3, TP4, TP5	Test Point PC Mini .040"D Yellow	36-5004-ND
32	1	U2	IC, USB 2.0 Hub, 4 Port, QFN48	XR22414CL48-F
33	4	U4, U5, U6, U7	USB Current Monitor, DFN8 2x3	XRP2527IHB-1-F
34	1	U8	LDO 5V to 3.3V	SP6260GEK-L/TR_DNI
35	1	U3	Hex Inverter IC	SN74LVC14ADRG3
36	1	Y1	12MHz \pm 20ppm Crystal 18pF -20°C ~ 70°C 4-SMD	ABMM-12.000MHZ-B2-T

Note: Part numbers marked _DNI are not installed.

Revision History

Revision	Date	Description
1A	February 2017	Initial release

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